Unmasking Deception : A Deep Learning Approach with AutoEncoders and Attention Mechanism

Bachelor in Applied Computer Science and Artificial Intelligence

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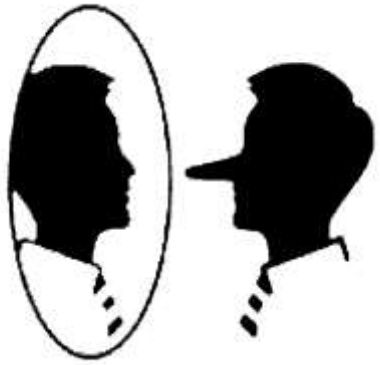
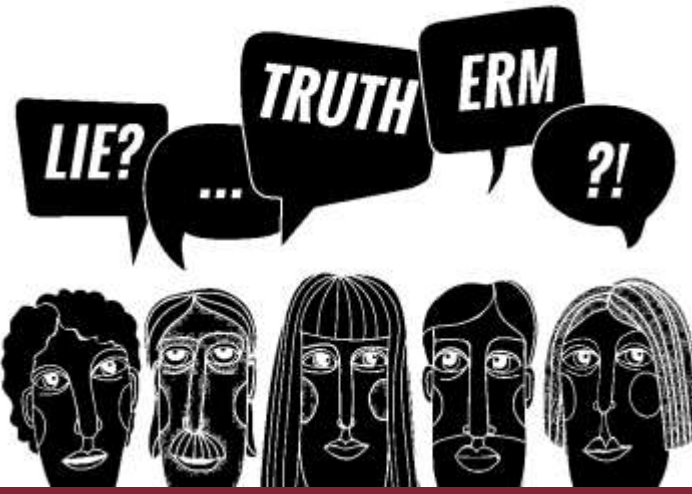
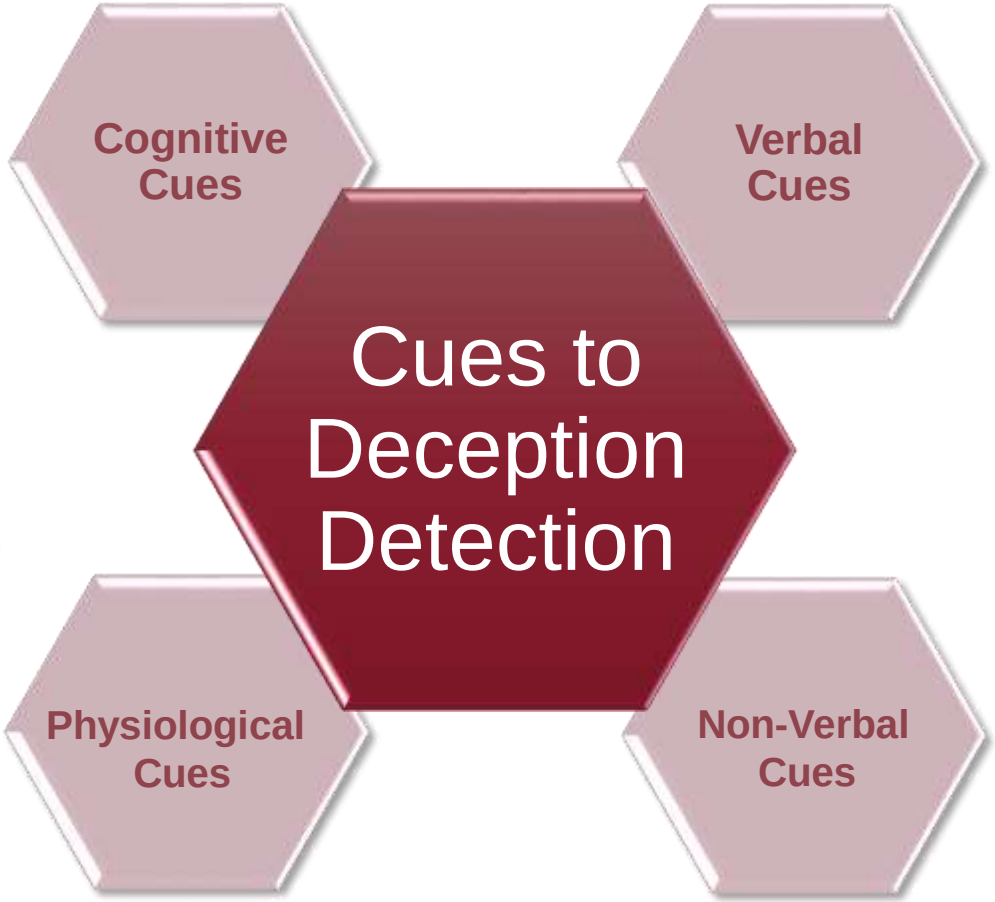
Deception Detection



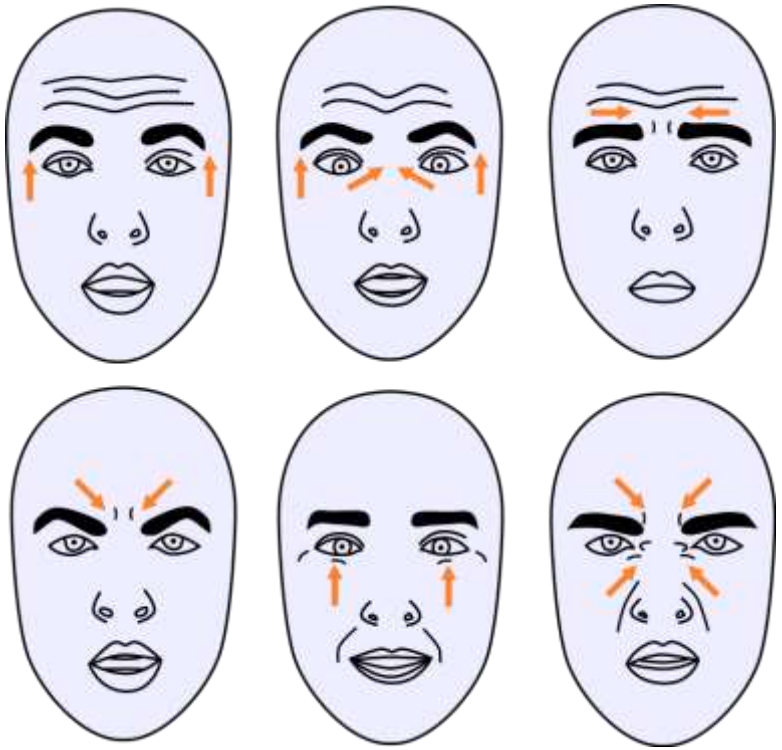
- Deception is defined as an intentional attempt to mislead others
- Humans are able to detect deception with an accuracy of only 54%
- Shift towards AI and ML models to mitigate potential biases and enhance objectivity



Cues to Deception Detection



Microexpressions



- Alteration in facial features resulting from the movement of facial muscles triggered by neural reflexes
- Often unnoticeable, they emerge rapidly and involountary, with a usual duration of less than 0.5 seconds

Problems

Data Accessibility

Invasive Approaches

Artificially Generated Data

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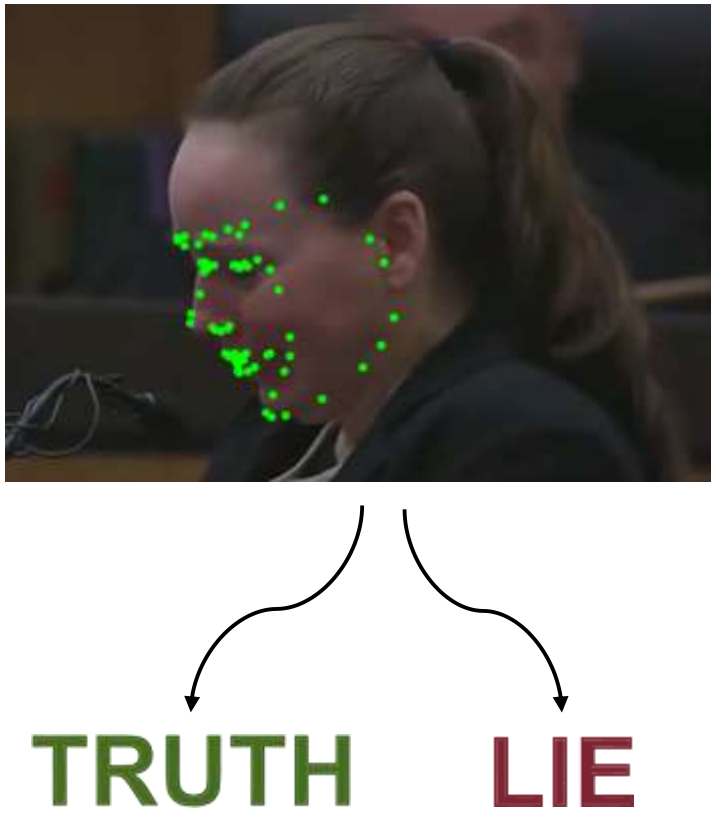
Scenarios for Deception Detection

Objective

The objective of this project is to develop a method capable of discerning whether a person is lying through the analysis of micro facial expressions.

- Unimodal Approach
- Real – Life Trial Dataset



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Real – Life Trial Dataset

No. of VIDEOS	FPS	STAKES	LABELS	FACIAL LABELS	AVAILABILITY
121	10-30	HIGH	60 TRUTHFUL 61 DECEITFUL	MUMIN	PUBLIC

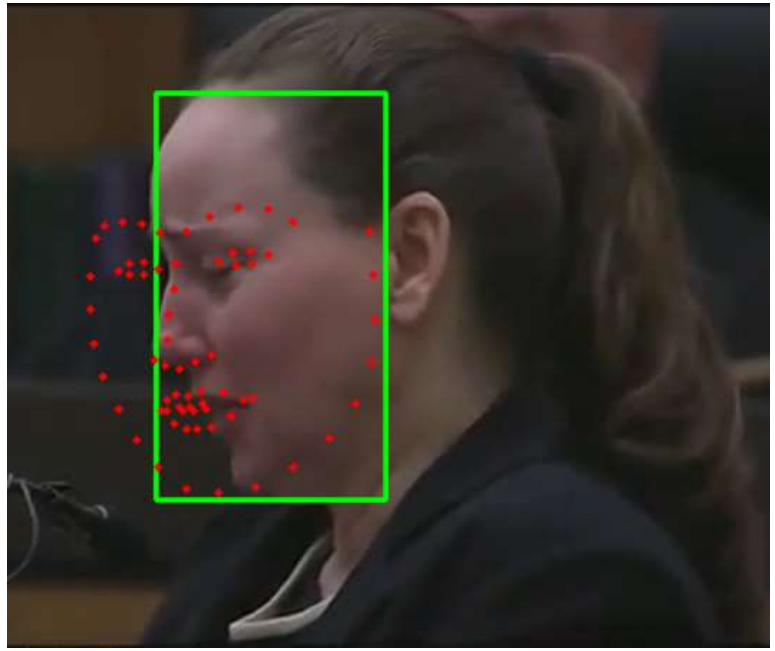
PROBLEMS

- Video Dynamism
- Low Video Quality

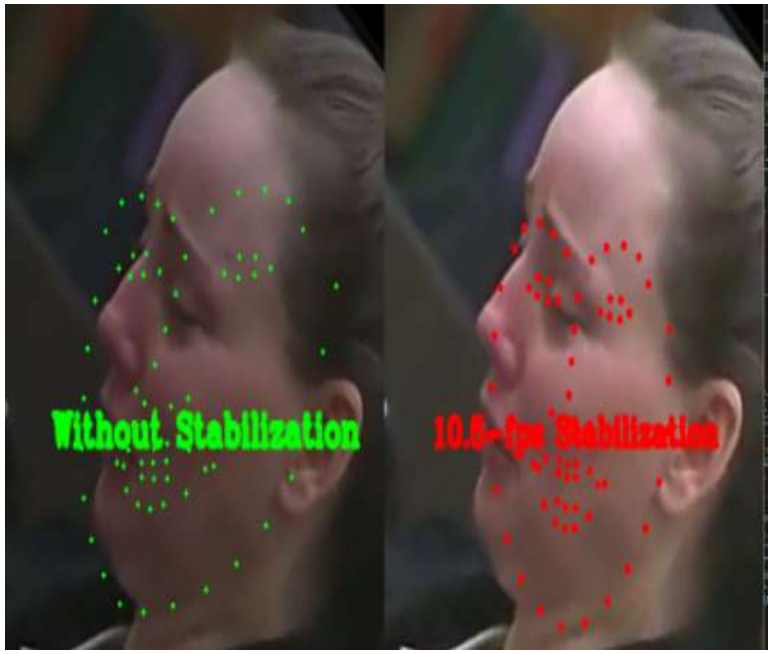
SOLUTIONS

- Spatial and Temporal Cropping
- Linear Interpolation of the Extracted Features

Experiments



- ***Face Detection :*** DNN OpenCV
- ***MicroExpression Detection :*** Dlib Library



- ***Face Detection :*** DNN OpenCV
- ***MicroExpression Detection :*** Dlib Library with Face Alignment & Normalization

- ***Face Detection & MicroExpression Detection :*** MediaPipe

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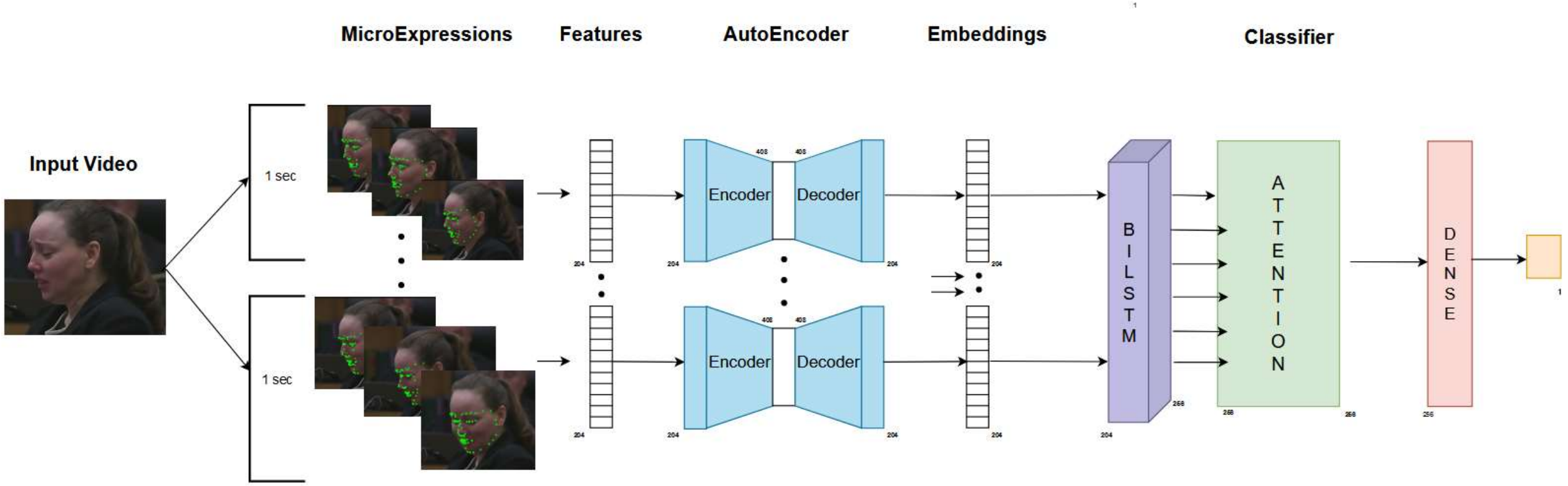
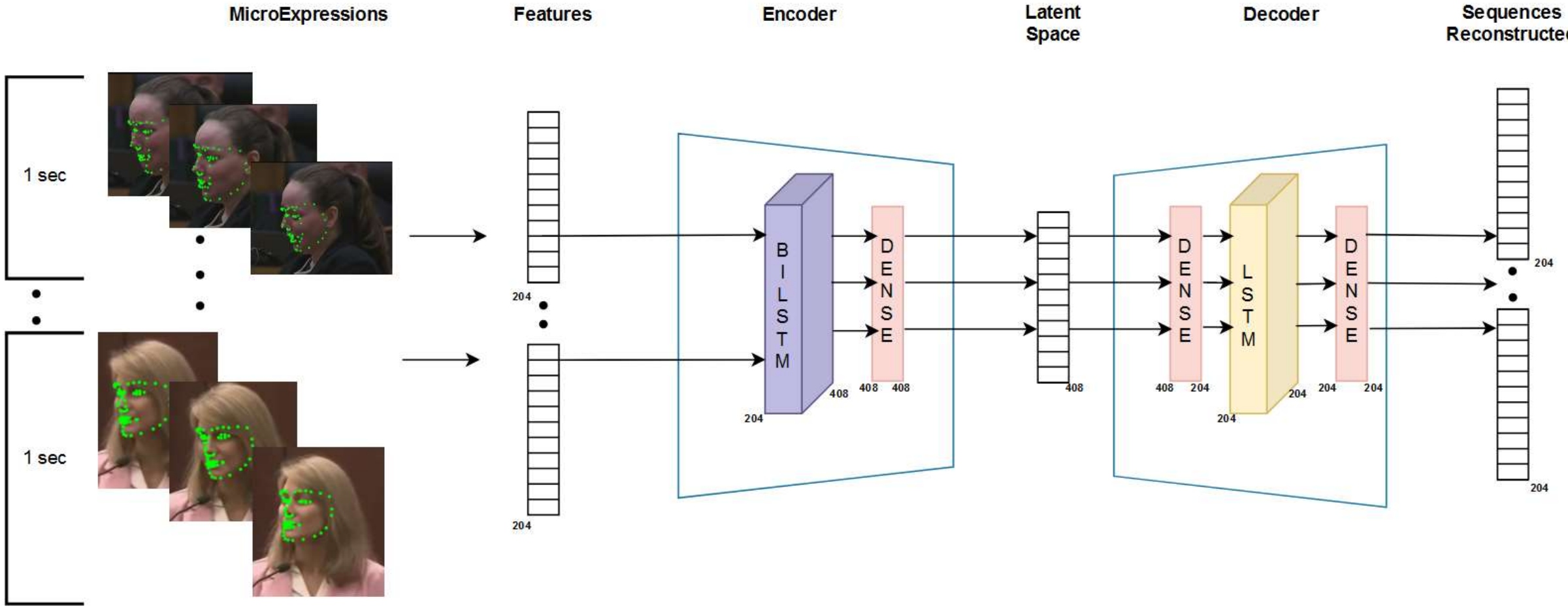
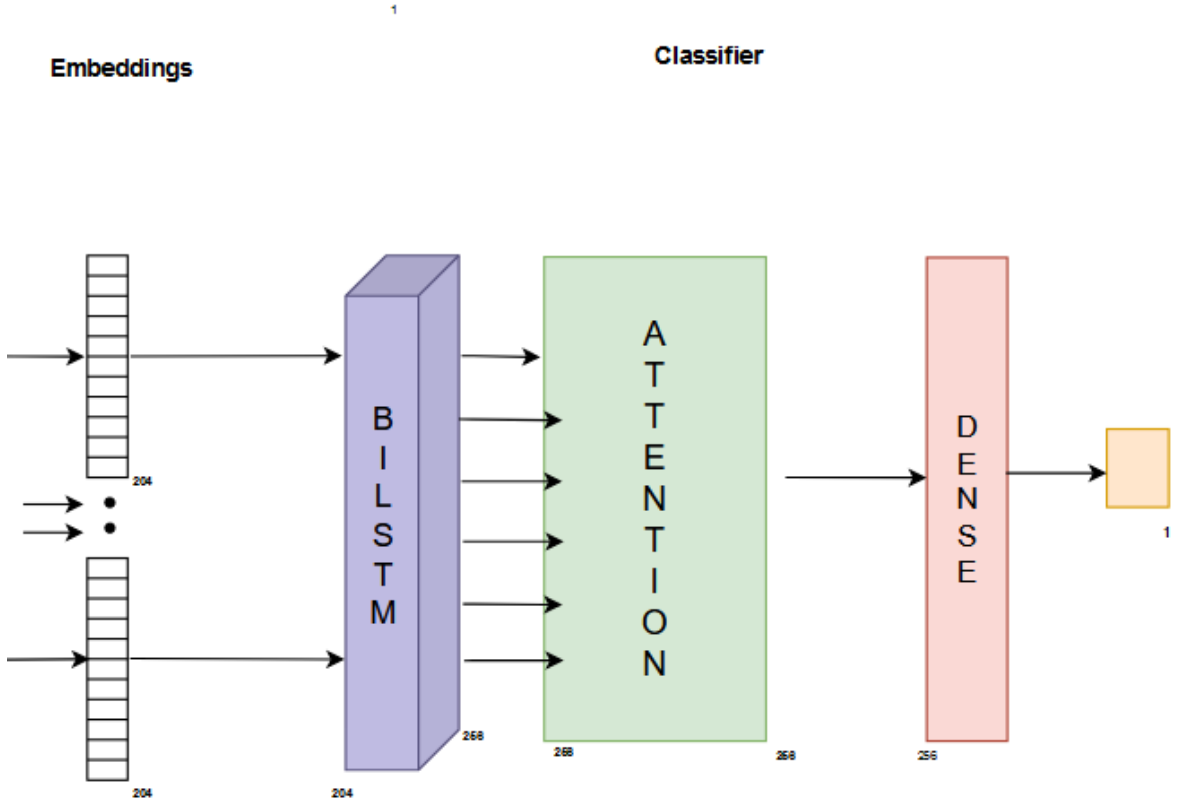
AutoDeception



AutoEncoder



Classifier & Attention



- **Attention** allows to capture the **relevant** information for the AI model to make the **judgment of deception**
- **Attention scores** are calculated using the dot product between k and q
- Scores are then **scaled** by the square root of the number of channels

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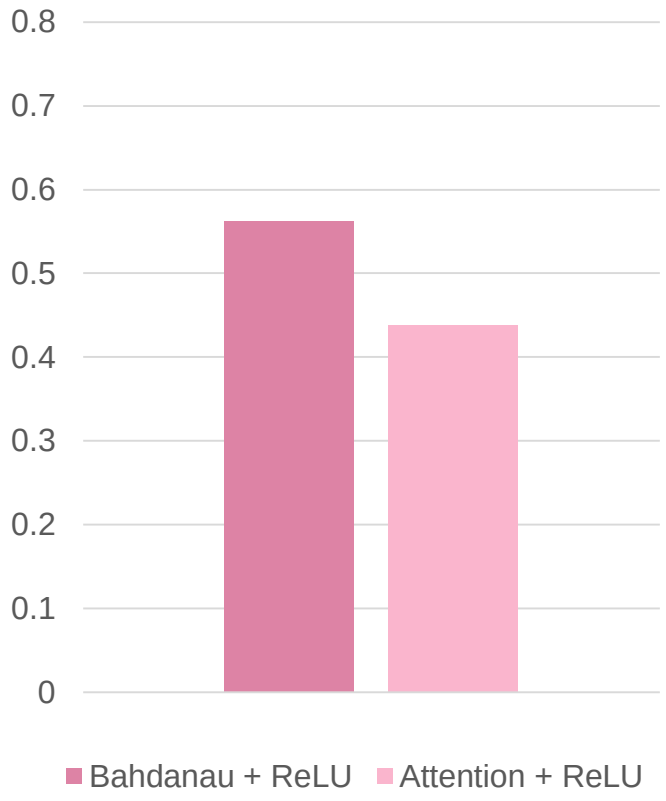
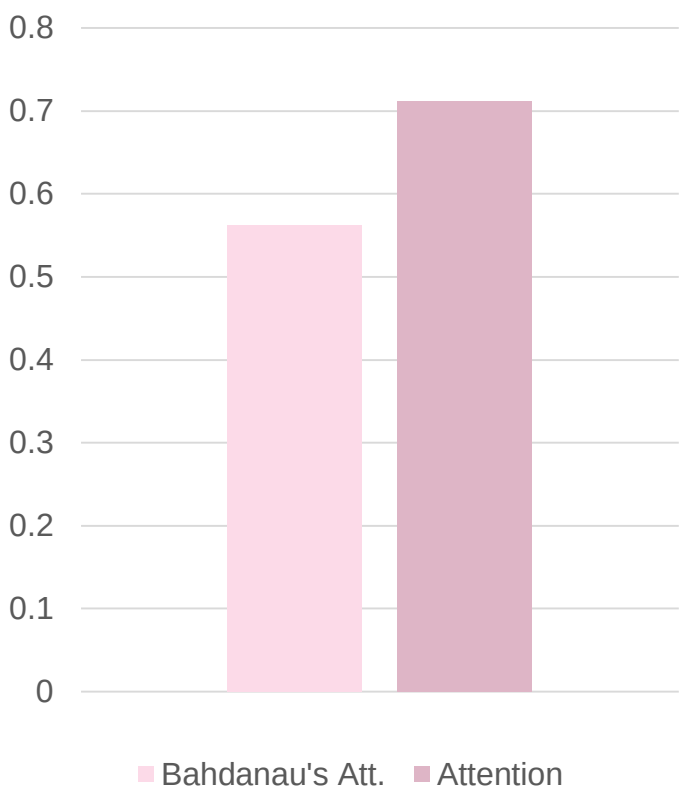
Model's Accuracy

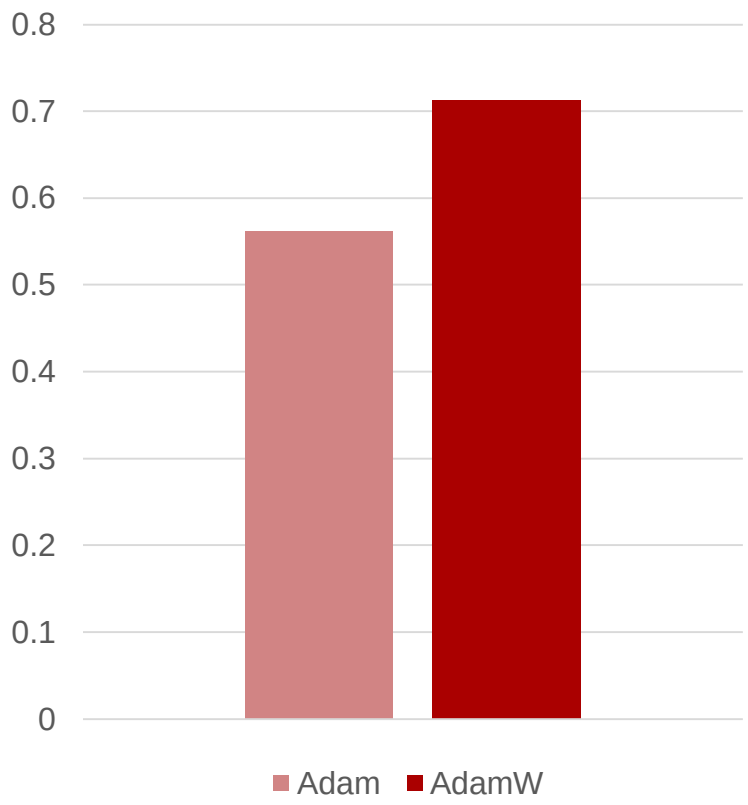
Attention Mechanisms + ReLU



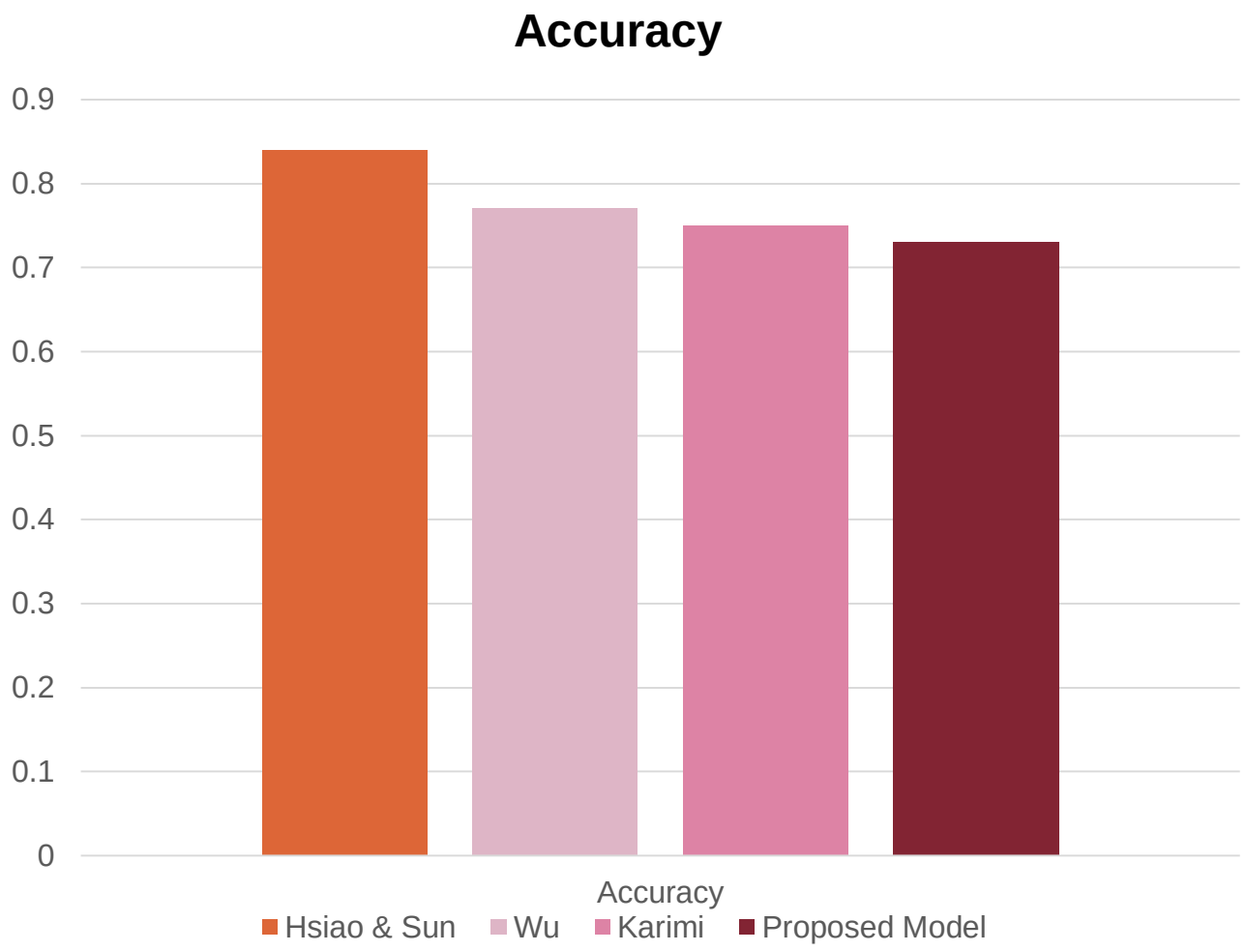
Attention Mechanisms + GELU

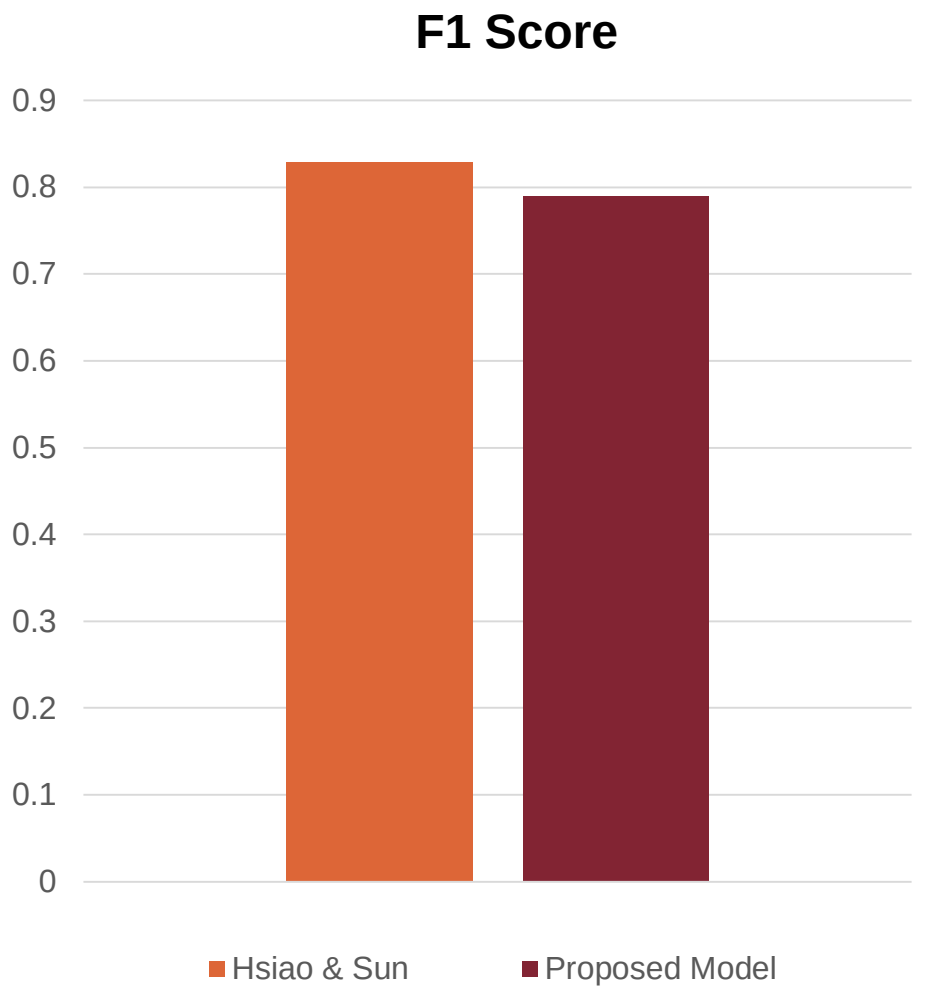


Optimizer



Visual Comparison





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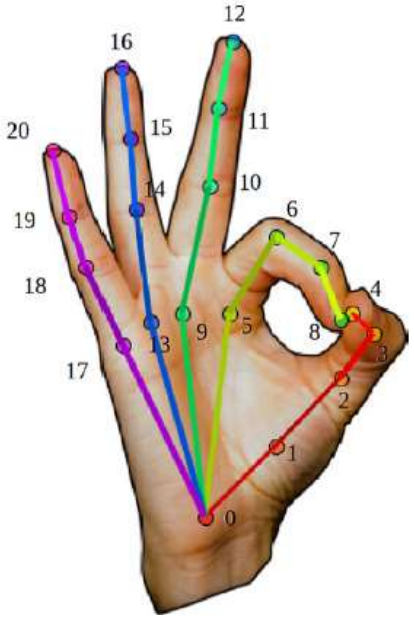
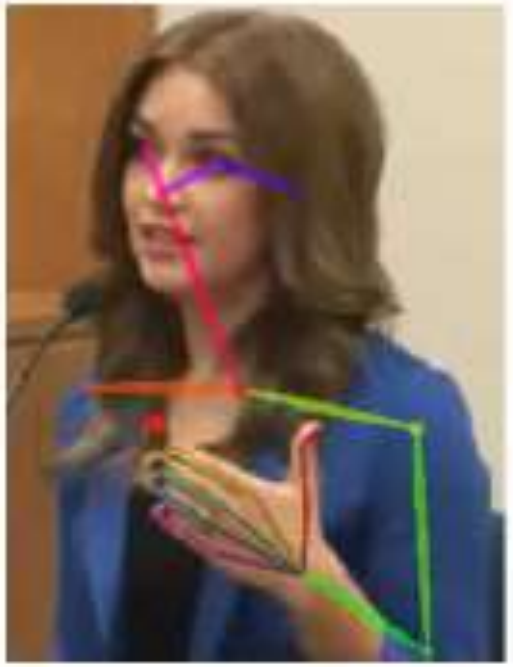
Future Works

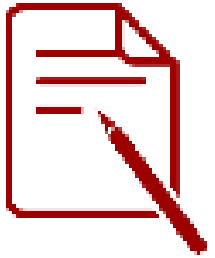
- **Hand Gesture & Body Language**





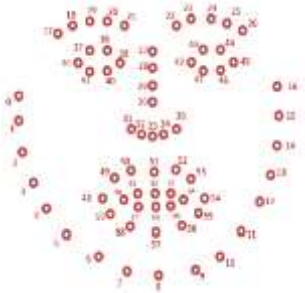
- **Multimodal Approaches**

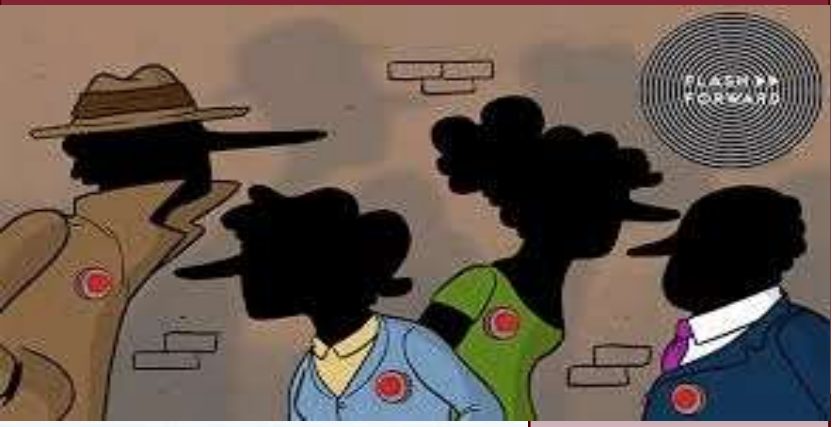
Verbal Features

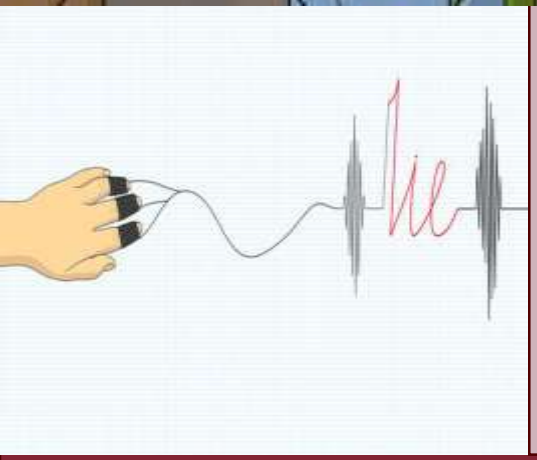


Audio Features

Visual Features







Thank you

for your attention!

Questions ?